

**APPENDIX B**

What is claimed is:

1 1. A biodetector for the detection of a selected substance, said biodetector comprising:

5 a signal converting element, comprising (i) an extracellular ligand-specific binding domain which specifically binds said selected substance, wherein said ligand-specific binding domain comprises an epitope-binding fragment of an antibody, and (ii) an intracellular signal transforming domain derived from PhoQ, wherein binding of said substance to said epitope-binding fragment of said ligand-specific binding domain  
10 activates said intracellular signal transforming domain providing an activated intracellular signal transforming domain;

1 a transducer, wherein (i) said transducer has an inactive form and an active form which are distinct from each other, and (ii) said activated intracellular signal transforming domain converts said inactive form of said transducer into said active form of said  
15 transducer;

a transcription control element comprising the phoN promoter, wherein expression mediated by said transcription control element is activated by said active form of said transducer; and

20 a reporter gene operatively linked to said transcription control element, wherein expression of said reporter gene mediated by said transcription control element causes expression of a reporter gene product that provides a detectable signal, wherein said detectable signal is detected optically by bioluminescence detection or fluorescence detection.

25 4. The biodetector of Claim 1, wherein said detectable signal is detectable by bioluminescence detection.

35 5. The biodetector of Claim 1, wherein said reporter gene encodes a luciferase.

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5 ~~6~~11. The biodetector of Claim 1, wherein said epitope-binding fragment of an antibody is selected from the group consisting of a single chain variable fragment (ScFv), a Fab fragment, a F(ab')<sub>2</sub> fragment, an epitope-binding fragment of a polyclonal antibody, an epitope-binding fragment of a monoclonal antibody, an epitope-binding fragment of a humanized antibody, an epitope-binding fragment of a chimeric antibody, and an epitope-binding fragment of an anti-idiotypic antibody.

10 12. The biodetector of Claim 11, wherein said epitope-binding fragment of an antibody comprises a single chain variable fragment (ScFv).

13. The biodetector of Claim 1, wherein said biodetector comprises an intact bacterial cell.

15 14. The biodetector of Claim 13, wherein said biodetector comprises a Gram-positive bacterial cell.

20 15. The biodetector of Claim 14, wherein said bacterial cell is selected from the group consisting of *Streptococcus*, *Staphylococcus*, *Listeria*, *Clostridium*, *Bacillus*, and *Corynebacteria*.

16. The biodetector of Claim 13, wherein said biodetector comprises a Gram-negative bacterial cell.

25 17. The biodetector of Claim 16, wherein said bacterial cell is selected from the group consisting of *Escherichia*, *Salmonella*, *Pseudomonas*, *Helicobacter*, *Shigella*, *Proteus*, *Bordetella*, *Neisseria*, *Haemophilus*, *Bacteriodes*, *Vibrio*, *Brucella*, *Campylobacter*, *Klebsiella*, and *Yersinia*.

18. A library of biodetectors, comprising:

at least about 1000 biodetectors of Claim 13, wherein the extracellular ligand-specific binding domain of each of said biodetectors comprises a different antibody fragment.

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5     ~~15~~<sup>25</sup>. The biodetector of Claim 1, wherein said detectable signal is detectable by fluorescence detection.

~~16~~<sup>26</sup>. The biodetector of Claim ~~25~~<sup>15</sup>, wherein said reporter gene encodes a fluorescent protein.

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~~4~~<sup>27</sup>. The biodetector of Claim ~~3~~<sup>3</sup>, wherein said luciferase is encoded by a *luc* gene.

~~5~~<sup>28</sup>. The biodetector of Claim ~~3~~<sup>3</sup>, wherein said luciferase is encoded by a *lux* gene.

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~~17~~<sup>29</sup>. The biodetector of Claim ~~3~~<sup>8</sup>, wherein said bacterial cell comprises a luciferase operon.

~~15~~<sup>30</sup>. The biodetector of claim 1, wherein said bioluminescence detection or fluorescence detection is performed using a charge coupled device camera.

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~~114~~<sup>31</sup>. An ordered array of the library of biodetectors of claim ~~18~~<sup>13</sup>.

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